EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	0	realnetwork and "all" with categories	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/06/07 08:28
L2	0	realnetwork with categories	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/06/07 08:56
L3	0	nummerical with (statment or expression or string or query) and (attribute or metadata or characteristic) with (repository or database or storage or table or dictionary) and co$occurence with word	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/06/07 08:58
L4	1	(nummerical or number) same (statment or expression or string or query) and (attribute or metadata or characteristic) same (repository or database or storage or table or dictionary) and co$occurence with word	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/06/07 08:59
L5	1	(nummerical or number) and (statment or expression or string or query) and (attribute or metadata or characteristic) same (repository or database or storage or table or dictionary or library) and co$occurence with word	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/06/07 09:11
L6	10	(nummerical or number) and (statment or expression or string or query) and (attribute or metadata or characteristic) same (repository or database or storage or table or dictionary or library) and co$occurence	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/06/07 09:26
L7	40138	(nummerical or number) same (statment or expression or string or query) and (attribute or metadata or characteristic) same (repository or database or storage or table or dictionary or library)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/06/07 09:27

EAST Search History

L8	5522	(nummerical or number) same (statment or expression or string or query) same (attribute or metadata or characteristic) same (repository or database or storage or table or dictionary or library)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/06/07 09:33
L9	0	(nummerical or number) with (statment or expression or string or query) with (attribute or metadata or characteristic) with (repository or database or storage or table or dictionary or library) same occurence same omission	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/06/07 09:44
L10	0	(nummerical or number) with (statment or expression or string or query) with (attribute or metadata or characteristic) with (repository or database or storage or table or dictionary or library) and occurence same omission	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/06/07 09:45
L11	0	(nummerical or number) with (statment or expression or string or query) with (attribute or metadata or characteristic) with (repository or database or storage or table or dictionary or library) and occurence and omission	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/06/07 09:45

Google Scholar BETA expression attribute dictionary cooccurence w 1999 - 2003 Search Adv Sch Sch

Scholar Results **1** - **1** of **1** for **expression attribute dictionary cooccurence word**. (**0.10** seconds)

Tip: Click to get a definition of: expression attribute word
Or just click on the underlined words in the above colored bar

Project ref. no. IST-1999-11438 Project acronym MUCHMORE **All articles** Recent articles
Project full title - group of 2 »
PU Type - Month, 2001 - muchmore.dfki.de
... a **word** in question in a **dictionary**, and computing ... The English **word** "drug" when referring to medically therapeutic ... Collocations and multiword **expressions**. ...
View as HTML - Web Search

expression attribute dictionary cooc Search

Google Home - About Google - About Google Scholar

Google Scholar BETA numerical expression attribute dictionary cooc Search Advanced Scholar Search Scholar Preferences Scholar Help

Scholar Results **1** - **2** of **2** for **numerical expression attribute dictionary cooccurence word** . (**0.09** second

Tip: Click to get a definition of: numerical expression attribute word
Or just click on the underlined words in the above colored bar

[BOOK] Yir-Yoront Lexicon: Sketch and **Dictionary** of an Australian Language **All articles** Recent articles
B Alpher - 1992 - books.google.com
... Yoront and neighbouring groups is shown in Map 1. **Numerical** designations ofthe ...
final-a and echo-vowel patterns, locate the **word** in the **dictionary** in what ...
Cited by 9 - Web Search - Library Search

Project ref. no. IST-1999-11438 Project acronym MUCHMORE Project full title - group of 2 »
PU Type - Month, 2001 - muchmore.dfki.de
... a **word** in question in a **dictionary**, and computing ... The English **word** "drug" when referring
to medically therapeutic ... Collocations and multiword **expressions**. ...
View as HTML - Web Search

numerical expression attribute dictio Search

Google Home - About Google - About Google Scholar

```
File 275:Gale Group Computer DB(TM) 1983-2006/Jun 06
         (c) 2006 The Gale Group
File 621:Gale Group New Prod.Annou.(R) 1985-2006/Jun 07
         (c) 2006 The Gale Group
File 636:Gale Group Newsletter DB(TM) 1987-2006/Jun 06
         (c) 2006 The Gale Group
File  16:Gale Group PROMT(R) 1990-2006/Jun 07
         (c) 2006 The Gale Group
File 160:Gale Group PROMT(R) 1972-1989
         (c) 1999 The Gale Group
File 148:Gale Group Trade & Industry DB 1976-2006/Jun 07
         (c)2006 The Gale Group
File 624:McGraw-Hill Publications 1985-2006/Jun 08
         (c) 2006 McGraw-Hill Co. Inc
File  15:ABI/Inform(R) 1971-2006/Jun 07
         (c) 2006 ProQuest Info&Learning
File 647:CMP  Computer Fulltext 1988-2006/Jul W2
         (c) 2006 CMP Media, LLC
File 674:Computer News Fulltext 1989-2006/Jun W1
         (c) 2006 IDG Communications
File 696:DIALOG Telecom. Newsletters 1995-2006/Jun 07
         (c) 2006 Dialog
File 369:New Scientist 1994-2006/Jun W1
         (c) 2006 Reed Business Information Ltd.

Set     Items   Description
S1     450233   (NUMERICAL? OR MATH OR MATHEMATIC? OR ARITHMETIC? OR GEOME-
             TR? OR ALGEBR? OR VOLUME? OR QUANTI?)(1W)(EXPRESSION? ? OR FU-
             NCTION? ? OR STATEMENT? ? OR SENTENCE? ? OR PHRASE? ?) OR FOR-
             MULA??
S2       1807   S1(5N)INPUT????
S3      14574   S1(5N)(RETRIEV??? OR SEARCH??? OR ACQUIR??? OR ACQUISITION-
             ??? OR OBTAIN??? OR QUERY??? OR QUERIE? ? OR FIND??? OR LOCAT-
             E? ? OR LOCATING)
S4       7668   S1(10N)(PARS??? OR EXTRACT??? OR BREAK??? OR BROKEN OR REC-
             OGNI?)
S5    2102476   DICTIONAR??? OR DEFIN??? OR DEFINITION? ?
S6    4617103   DATABASE? ? OR DATA()BASE? ? OR LIBRAR??? OR REPOSITOR??? -
             OR DIRECTORY OR DIRECTORIES OR TABLE? ?
S7     316377   S5:S6(5N)(ATTRIBUTE? ? OR PROPERTY OR PROPERTIES OR COMPON-
             ENT? ? OR ELEMENT? ? OR METADATA OR META()DATA OR PARAMETER? ?
              OR FEATURE? ? OR STRING? ? OR CHARACTERISTIC? ?)
S8         61   S1(10N)(PREFIX?? OR PRE()FIX??)
S9        101   S5(5N)(CO()OCCUR????? OR COOCCUR? OR OCCUR???)(5N)(TOGETHER
              OR SAME()TIME OR SIMULTANEOUS? OR CONCURREN? OR COINCIDEN?)
S10       101   S2(50N)(S3:S4 OR S7:S9)
S11        85   RD  (unique items)
S12        10   S2:S3(50N)S4(50N)S7:S9
S13       221   S2:S4(50N)S7:S9
S14       177   RD  (unique items)
S15       163   S14 NOT PY=2003:2006
S16         6   S2:S4(50N)S8:S9
S17         0   S1(50N)S9
S18         0   S1(100N)S9
S19     22692   (NUMERICAL? OR MATH OR MATHEMATIC? OR ARITHMETIC? OR GEOME-
             TR? OR ALGEBR? OR VOLUME? OR QUANTI?)(1W)(EXPRESSION? ? OR FU-
             NCTION? ? OR STATEMENT? ? OR SENTENCE? ? OR PHRASE?)
S20       523   S19(5N)INPUT????
S21      2010   S19(5N)(RETRIEV??? OR SEARCH??? OR ACQUIR??? OR ACQUISITIO-
             N??? OR OBTAIN??? OR QUERY??? OR QUERIE? ? OR FIND??? OR LOCA-
             TE? ? OR LOCATING)
S22       362   S19(10N)(PARS??? OR EXTRACT??? OR BREAK??? OR BROKEN OR RE-
             COGNI?)
S23         3   S19(10N)(PREFIX?? OR PRE()FIX??)
S24        33   S20(50N)S21:S22
```

S25	11	S21(5ON)S22
S26	57	S20:S22(5ON)S7:S9
S27	114	S12 OR S16 OR S23 OR S24:S26
S28	100	RD (unique items)
S29	96	S28 NOT PY=2003:2006

29/3,K/7 (Item 7 from file: 275)
DIALOG(R)File 275:Gale Group Computer DB(TM)

01504430 SUPPLIER NUMBER: 11970584 (USE FORMAT 7 OR 9 FOR FULL TEXT)
Software lite: integrated packages streamline your business computing. (Software Review) (overview of nine evaluations of integrated software packages) (Evaluation)
Smith, Jan
PC-Computing, v5, n4, p182(12)
April, 1992
DOCUMENT TYPE: Evaluation ISSN: 0899-1847 LANGUAGE: ENGLISH
RECORD TYPE: FULLTEXT; ABSTRACT
WORD COUNT: 1098 LINE COUNT: 00083

... database. We also evaluated the individual modules, looking at such common requirements as text formatting, **mathematical functions** in the spreadsheet, and **search** and query **features** in the **database** . For price and performance comparison, we tried the same set of tasks using standalone programs...

29/3,K/8 (Item 8 from file: 275)
DIALOG(R)File 275:Gale Group Computer DB(TM)

01499755 SUPPLIER NUMBER: 11892641 (USE FORMAT 7 OR 9 FOR FULL TEXT)
Transform data tables. (Data Table Labeled commands) (Tutorial)
Maguiness, David
Lotus, v8, n2, p49(4)
Feb, 1992
DOCUMENT TYPE: Tutorial ISSN: 8756-7334 LANGUAGE: ENGLISH
RECORD TYPE: FULLTEXT; ABSTRACT
WORD COUNT: 2680 LINE COUNT: 00197

... Table 1, 2, and 3 commands, DTL commands let you use an unlimited number of **input** variables and **formulas** , **break** up the table with blank rows or columns, use labels to identify **table components** , and vary the location of your **input** variables, **formulas** , and results.
What it is
The worksheet in figure 3 shows the periodic payments required for loans of various terms and interest rates. We'll create this **table** to illustrate the **elements** of a labeled **table** .
Start in a blank worksheet and set the column width to 14: In Release 3...

29/3,K/16 (Item 16 from file: 275)
DIALOG(R)File 275:Gale Group Computer DB(TM)

01264837 SUPPLIER NUMBER: 07259735
Beyond word processing; products that make your word processing more productive.
Spencer, Cheryl
Macworld, v6, n2, p188(9)
Feb, 1989
ISSN: 0741-8647 LANGUAGE: ENGLISH RECORD TYPE: ABSTRACT

...ABSTRACT: a word processing effort more productive include: outliners, spelling checkers and thesauri, grammar checkers, bibliographic **databases** , **string search** programs, **mathematical expression** editors, and variety of miscellaneous programs that do not fit in any particular category. Some...

29/3,K/18 (Item 18 from file: 275)
DIALOG(R)File 275:Gale Group Computer DB(TM)

01241348 SUPPLIER NUMBER: 06543489 (USE FORMAT 7 OR 9 FOR FULL TEXT)
Your table is ready. (using table-lookup functions)
Hildebrand, Robert
Lotus, v4, n4, p66(5)
April, 1988
ISSN: 8756-7334 LANGUAGE: ENGLISH RECORD TYPE: FULLTEXT; ABSTRACT
WORD COUNT: 3016 LINE COUNT: 00219

... string, while 123 is a number. (Note that 1-2-3 Release 1A cannot handle **strings** ; therefore, your lookup **tables** are restricted to numeric data only.)
Take a look at figure 2, which contains two...

...fact, you can often use an existing database as a lookup table and write @VLOOKUP **formulas** to **extract** selected data from it.
In the sales records starting in row 21, all you need...

...enter is the product number in column A and the quantity in column B. @VLOOKUP **formulas** **retrieve** the rest of the information from the two tables and calculate the total amount due...

29/3,K/20 (Item 20 from file: 275)
DIALOG(R)File 275:Gale Group Computer DB(TM)

01212835 SUPPLIER NUMBER: 05158813 (USE FORMAT 7 OR 9 FOR FULL TEXT)
Beyond number crunching. (products that add database management and word processing capabilities to Lotus 1-2-3)
Badgett, Tom
PC Magazine, v6, n13, p289(16)
July 21, 1987
ISSN: 0888-8507 LANGUAGE: ENGLISH RECORD TYPE: FULLTEXT; ABSTRACT
WORD COUNT: 2761 LINE COUNT: 00199

... to select specific records. In this sample we have used cell M5 to display the **formula** used as part of the **search** criteria in L5. Such a **formula** displays a 1 or a 0 for true or false; so, to provide additional worksheet...

...it is a good idea to show the formula as a label by reentering the **formula** in another cell with a 1-2-3 label **prefix** . Note that this is a relative **formula** , so you need to specify only the first cell in the database that points to...

29/3,K/27 (Item 1 from file: 16)
DIALOG(R)File 16:Gale Group PROMT(R)

02977542 Supplier Number: 44035906 (USE FORMAT 7 FOR FULLTEXT)
British firm taps DSP for image-processing work
Electronic Engineering Times, p25
August 16, 1993
Language: English Record Type: Fulltext
Document Type: Magazine/Journal; Trade
Word Count: 702

... used separately or in combination. The processing library, called IProc, contains routines for the basic **mathematical** **functions** needed in

image processing.
The **feature - extraction library** , IFeature, works at a higher level, classifying shapes, detecting boundaries and counting objects. Finally, the...

29/3,K/28 (Item 1 from file: 160)
DIALOG(R)File 160:Gale Group PROMT(R)

02337340
NTT Develops New Distortion Analyzer
Comline Telecommunications October 9, 1989 p. 1

... signal distortion on telephone lines. According to NTT, EPOQ is the first testing device to **feature input** storage, **database** , and **quantizing functions** in one unit. The system compares analog or digital audio inputs with synthesized audio signals from its built-in CD-ROM. The **quantizing function** grades the **input** signal (within about 40 seconds) into one of five levels depending on the amount of...

29/3,K/45 (Item 17 from file: 148)
DIALOG(R)File 148:Gale Group Trade & Industry DB

10711176 SUPPLIER NUMBER: 53449299 (USE FORMAT 7 OR 9 FOR FULL TEXT)
Recovering output-specific inputs from aggregate input data: a generalized cross-entropy approach.
Lence, Sergio H.; Miller, Douglas J.
American Journal of Agricultural Economics, 80, 4, 852(1)
Nov, 1998
ISSN: 0002-9092 LANGUAGE: English RECORD TYPE: Fulltext; Abstract
WORD COUNT: 8471 LINE COUNT: 00720

... Posterior Distributions." J. Econometrics 37(February 1988): 195-209.
Appendix A
Experimental Design Details
Essential **inputs** are **obtained** (**Mathematical Expression** Omitted), where logist(.) denotes the logistic CDF and (a.sub.ijt) are normal random variables:
(A.1) (Mathematical Expression Omitted)
(A.2) (**Mathematical Expression** Omitted).
Input one is meant to represent a fixed allocatable input (e.g., land), so that the...

29/3,K/91 (Item 63 from file: 148)
DIALOG(R)File 148:Gale Group Trade & Industry DB

03928760 SUPPLIER NUMBER: 07774131 (USE FORMAT 7 OR 9 FOR FULL TEXT)
Solver software makes long calculations easy.
Dvorak, Paul
Machine Design, v61, n13, p107(2)
June 22, 1989
DOCUMENT TYPE: evaluation ISSN: 0024-9114 LANGUAGE: ENGLISH
RECORD TYPE: FULLTEXT
WORD COUNT: 1103 LINE COUNT: 00087

... TK is most useful when solving a long string of equations, such as those that **define** gear **parameters** , structural **characteristics** , or circuit analysis. To this end, the program includes three disks of library models. These include **mathematical functions** for **finding** roots,

integrating and differentiating, solving differential equations, and curve fitting. Roark's Formulas for Stress...

```
File   8:Ei Compendex(R) 1970-2006/May W4
         (c) 2006 Elsevier Eng.  Info. Inc.
File  35:Dissertation Abs Online 1861-2006/May
         (c) 2006 ProQuest Info&Learning
File  65:Inside Conferences 1993-2006/Jun 08
         (c) 2006 BLDSC all rts. reserv.
File   2:INSPEC 1898-2006/May W4
         (c) 2006 Institution of Electrical Engineers
File  94:JICST-EPlus 1985-2006/Mar W1
         (c)2006 Japan Science and Tech Corp(JST)
File   6:NTIS 1964-2006/May W3
         (c) 2006 NTIS, Intl Cpyrght All Rights Res
File 144:Pascal 1973-2006/May W2
         (c) 2006 INIST/CNRS
File 434:SciSearch(R) Cited Ref Sci 1974-1989/Dec
         (c) 1998 Inst for Sci Info
File  34:SciSearch(R) Cited Ref Sci 1990-2006/Jun W1
         (c) 2006 Inst for Sci Info
File  99:Wilson Appl. Sci & Tech Abs 1983-2006/Apr
         (c) 2006 The HW Wilson Co.
File 266:FEDRIP 2005/Dec
         Comp & dist by NTIS, Intl Copyright All Rights Res
File  95:TEME-Technology & Management 1989-2006/Jun W1
         (c) 2006 FIZ TECHNIK
File 239:Mathsci 1940-2006/Jul
         (c) 2006 American Mathematical Society

Set     Items   Description
S1      89643   (NUMERICAL? OR MATH OR MATHEMATIC? OR ARITHMETIC? OR GEOME-
             TR? OR ALGEBR? OR VOLUME? OR QUANTI?)(1W)(EXPRESSION? ? OR FU-
             NCTION? ? OR STATEMENT? ? OR SENTENCE? ? OR PHRASE? ?)
S2        308   S1(5N)INPUT????
S3       2367   S1(5N)(RETRIEV??? OR SEARCH??? OR ACQUIR??? OR ACQUISITION-
             ??? OR OBTAIN??? OR QUERY??? OR QUERIE? ? OR FIND??? OR LOCAT-
             E? ? OR LOCATING)
S4        422   S1(10N)(PARS??? OR EXTRACT??? OR BREAK??? OR BROKEN)
S5    2420127   DICTIONAR??? OR DEFIN??? OR DEFINITION? ?
S6    1738565   DATABASE? ? OR DATA()BASE? ? OR LIBRAR??? OR REPOSITOR??? -
             OR DIRECTORY OR DIRECTORIES OR TABLE? ?
S7     265165   S5:S6(5N)(ATTRIBUTE? ? OR PROPERTY OR PROPERTIES OR COMPON-
             ENT? ? OR ELEMENT? ? OR METADATA OR META()DATA OR PARAMETER? ?
              OR FEATURE? ? OR STRING? ? OR CHARACTERISTIC? ?)
S8         21   S1(10N)(PREFIX?? OR PRE()FIX??)
S9        172   S5(5N)(CO()OCCUR????? OR COOCCUR? OR OCCUR???)(5N)(TOGETHER
              OR SAME()TIME OR SIMULTANEOUS? OR CONCURREN? OR COINCIDEN?)
S10        75   S2 AND S3:S9
S11        11   S2 AND S3:S4
S12         4   S2 AND S7:S9
S13        55   S3 AND (S4 OR S7:S9)
S14        66   S11:S13
S15        48   RD  (unique items)
S16        41   S15 NOT PY=2003:2006
S17        18   S4 AND S7:S9
S18         1   S1 AND S9
S19      1246   S1 AND S7
S20        40   S8 OR S17:S18
S21        31   RD  (unique items)
S22        23   S21 NOT (S16 OR PY=2003:2006)
S23        21   S1 AND (CO()OCCUR????? OR COOCCUR?)
S24         4   S19 AND NATURAL()LANGUAGE? ?
S25         0   S19 AND (PREFIX?? OR PRE()FIX??)
S26        24   S23:S24
S27        20   RD  (unique items)
S28      1256   (S1 OR FORMULA??)(5N)RECOGNI?
S29        68   S28 AND S2:S4
```

S30	20	S28 AND (S7 OR S9)
S31	85	S29:S30
S32	62	RD (unique items)
S33	57	S32 NOT (S15 OR S22 OR S27)

16/5/1 (Item 1 from file: 8)
DIALOG(R)File 8:Ei Compendex(R)

07005757 E.I. No: EIP04368342958
Title: Logics with aggregate operators
Author: Hella, Lauri; Libkin, Leonid; Nurmonen, Juha; Wong, Limsoon
Corporate Source: Department of Mathematics University of Helsinki, 00014, Helsinki, Finland
Source: Journal of the ACM v 48 n 4 July 2001. p 880-907
Publication Year: 2001
CODEN: JOACF6 ISSN: 0004-5411
Language: English
Document Type: JA; (Journal Article) Treatment: T; (Theoretical)
Journal Announcement: 0409W2
Abstract: We study adding aggregate operators, such as summing up elements of a column of a relation, to logics with counting mechanisms. The primary motivation comes from database applications, where aggregate operators are present in all real life query languages. Unlike other features of query languages, aggregates are not adequately captured by the existing logical formalisms. Consequently, all previous approaches to analyzing the expressive power of aggregation were only capable of producing partial results, depending on the allowed class of aggregate and arithmetic operations. We consider a powerful counting logic, and extend it with the set of all aggregate operators. We show that the resulting logic satisfies analogs of Hanf's and Gaifman's theorems, meaning that it can only express local **properties** . We consider a **database** query language that expresses all the standard aggregates found in commercial query languages, and show how it can be translated into the aggregate logic, thereby providing a. number of expressivity bounds, that do not depend on a particular class of arithmetic functions, and that subsume all those previously known. We consider a restricted. 42 Refs.
Descriptors: *Formal logic; Mathematical operators; Theorem proving; **Query** languages; Digital **arithmetic** ; **Function** evaluation; Database systems; Problem solving
Identifiers: Aggregate operators; Arithmetic functions; Counting logic
Classification Codes:
723.1.1 (Computer Programming Languages)
721.1 (Computer Theory (Includes Formal Logic, Automata Theory, Switching Theory & Programming Theory)); 723.1 (Computer Programming); 921.6 (Numerical Methods); 723.3 (Database Systems); 723.4 (Artificial Intelligence)
721 (Computer Circuits & Logic Elements); 921 (Applied Mathematics); 723 (Computer Software, Data Handling & Applications)
72 (COMPUTERS & DATA PROCESSING); 92 (ENGINEERING MATHEMATICS)

16/5/2 (Item 2 from file: 8)
DIALOG(R)File 8:Ei Compendex(R)

06789129 E.I. No: EIP04148097197
Title: Indexing of fuzzy regions
Author: Philipp-Foliguet, Sylvie; Vieira, Marcelo Bernardes; Sanfourche, Martial
Corporate Source: Equipe Traitement Images et du Sign. ENSEA/UCP, 95014 Cergy Cedex, France
Conference Title: Proceedings of the 6th Joint Conference on Information Sciences, JCIS 2002
Conference Location: Research Triange Park, NC, United States Conference Date: 20020308-20020313
Sponsor: Association for Intelligent Machinery; Information Sciences Journal; Duke University; Tamkang University
E.I. Conference No.: 62544
Source: Proceedings of the Joint Conference on Information Sciences v 6

2002.
Publication Year: 2002
ISBN: 0970789017
Language: English
Document Type: CA; (Conference Article) Treatment: T; (Theoretical)
Journal Announcement: 0404W1
Abstract: This paper first exposes an algorithm that leads to fuzzy segmentation of color images. This algorithm performs, as in the watershed method, a progressive flood of the gradient image from pixels of lowest gradients. Membership degrees of pixels to regions depend on topographic distance, which takes into account both the distance to the core and the gradient norms. Geometric and colorimetric **features** are **defined** to build a region signature. A distance between fuzzy regions is then proposed, allowing ranking fuzzy regions by similarity. Applications concern region indexing and retrieval. 10 Refs.
Descriptors: *Image segmentation; Fuzzy control; Indexing (of information); Color image processing; Feature **extraction** ; Impulse noise; Image **retrieval** ; Colorimetry; Surface topography; Computational **geometry** ; Membership **functions** ; Gradient methods; Algorithms
Identifiers: Image indexing; Watershed algorithms
Classification Codes:
723.2 (Data Processing); 741.1 (Light & Optics); 731.1 (Control Systems); 903.1 (Information Sources & Analysis); 723.5 (Computer Applications); 941.4 (Optical Variables Measurements); 931.2 (Physical Properties of Gases, Liquids & Solids); 921.4 (Combinatorial Mathematics, Includes Graph Theory, Set Theory); 921.6 (Numerical Methods)
723 (Computer Software, Data Handling & Applications); 741 (Light, Optics & Optical Devices); 731 (Automatic Control Principles & Applications); 921 (Applied Mathematics); 903 (Information Science); 941 (Acoustical & Optical Measuring Instruments); 931 (Applied Physics Generally)
72 (COMPUTERS & DATA PROCESSING); 74 (LIGHT & OPTICAL TECHNOLOGY); 73 (CONTROL ENGINEERING); 92 (ENGINEERING MATHEMATICS); 90 (ENGINEERING, GENERAL); 94 (INSTRUMENTS & MEASUREMENT); 93 (ENGINEERING PHYSICS)

16/5/9 (Item 9 from file: 8)
DIALOG(R)File 8:Ei Compendex(R)

04264995 E.I. No: EIP95102884287
Title: Automatic thesaurus construction supporting fuzzy retrieval of reusable components
Author: Damiani, E.; Fugini, M.G.
Corporate Source: Univ of Pavia, Pavia, Italy
Conference Title: Proceedings of the 1995 ACM Symposium on Applied Computing
Conference Location: Nashville, TN, USA Conference Date: 19950226-19950228
E.I. Conference No.: 43729
Source: Proceedings of the ACM Symposium on Applied Computing 1995. ACM, New York, NY, USA. p 542-547
Publication Year: 1995
CODEN: 002168
Language: English
Document Type: CA; (Conference Article) Treatment: T; (Theoretical)
Journal Announcement: 9512W1
Abstract: Effective access to **repositories** of reusable **components** should rely on retrieval functionalities based also on imprecise queries. This paper presents a fuzzy retrieval model based on keywords describing the functionalities of reusable components. Fuzzy weights are assigned to these keywords automatically. Retrieval is supported by a Thesaurus where a fuzzy synonymous relationship is used to compute adaptability of reusable components to the needs expressed by the user fuzzy query. The adaptability index is ameliorated along time via a quality function reporting feedback

on the system usage. (Author abstract) 19 Refs.
Descriptors: *Fuzzy sets; Computer software; **Mathematical** models; **Functions** ; Information **retrieval**
Identifiers: Automatic thesaurus construction; Fuzzy retrieval; Adaptability index; Reusable software components; Fuzzy term weighting; Usage driven tunability
Classification Codes:
921.4 (Combinatorial Mathematics, Includes Graph Theory, Set Theory); 723.1 (Computer Programming); 921.6 (Numerical Methods); 903.3 (Information Retrieval & Use)
921 (Applied Mathematics); 723 (Computer Software); 903 (Information Science)
92 (ENGINEERING MATHEMATICS); 72 (COMPUTERS & DATA PROCESSING); 90 (GENERAL ENGINEERING)

16/5/10 (Item 10 from file: 8)
DIALOG(R)File 8:Ei Compendex(R)

03877134 E.I. No: EIP94061306541
Title: Object-oriented query language facilitating construction of new objects
Author: Alhajj, R.; Arkun, M.E.
Corporate Source: Bilkent Univ, Bilkent, Turk
Source: Information and Software Technology v 35 n 9 Sep 1993. p 516-529
Publication Year: 1993
CODEN: ISOTE7 ISSN: 0950-5849
Language: English
Document Type: JA; (Journal Article) Treatment: A; (Applications); T; (Theoretical)
Journal Announcement: 9407W4
Abstract: In object-oriented database systems, messages can be used to manipulate the database; however, a query language is still a required **component** of any kind of **database** system. In the paper, we describe a query language for object-oriented databases where both objects as well as behaviour defined in them are handled. Not only existing objects are manipulated; the introduction of new relationships and new objects constructed out of existing ones is also facilitated. The operations supported in the described query language subsumes those of the relational algebra aiming at a more powerful query language than the relational algebra. Among the additional operators, there is an operator that handles the application of an aggregate function on objects in an operand while still having the result possessing the characteristics of an operand. The result of a query as well as the operands are considered to have a pair of sets, a set of objects and a set of message expressions; where a message expression is a sequence of messages. A message expression handles both stored and derived values and hence provides a full computational power without having an embedded query language with impedance mismatch. Therefore the closure property is maintained by having the result of a query possessing the **characteristics** of an operand. Furthermore, we **define** a set of objects and derive a set of message expressions for every class; hence any class can be an operand. Moreover, the result of a query has the characteristics of a class and its superclass/subclass relationships with the operands are established to make it persistent. (Author abstract) 38 Refs.
Descriptors: *Query languages; Object oriented programming; Database systems; Data handling; Algebra; Mathematical operators; Set theory; Computational complexity; Data structures
Identifiers: Object oriented **query** language; Object **algebra** ; Message **expression** ; Relational algebra; Computational power
Classification Codes:
723.3 (Database Systems); 723.1 (Computer Programming); 723.2 (Data Processing); 921.1 (Algebra); 921.4 (Combinatorial Mathematics, Includes Graph Theory, Set Theory); 721.1 (Computer Theory, Includes Formal Logic,

Automata Theory, Switching Theory, Programming Theory)
723 (Computer Software); 921 (Applied Mathematics); 721 (Computer Circuits & Logic Elements)
72 (COMPUTERS & DATA PROCESSING); 92 (ENGINEERING MATHEMATICS)

16/5/17 (Item 17 from file: 8)
DIALOG(R)File 8:Ei Compendex(R)

01501951 E.I. Monthly No: EI8403020289 E.I. Yearly No: EI84023735
Title: ABACUS: A NATURAL LANGUAGE FOR THE NUMERICAL COMPUTATION OF MATHEMATICAL FORMULAE.
Author: Luvisetto, M. L.; Ugolini, E.
Corporate Source: Centro Nazionale Analisi Fotogrammi, Istituto Nazionale di Fisica Nucleare, Bologna, Italy
Source: Computer Physics Communications v 30 n 3 Nov 1983 p 277-299
Publication Year: 1983
CODEN: CPHCBZ ISSN: 0010-4655
Language: ENGLISH
Journal Announcement: 8403
Abstract: The program ABACUS allows interactive computation of mathematical formulae, iterative procedures and metric conversions. The method involves **parsing** of **input** string and use of basic **mathematical functions** as supported by the language itself. The system has been designed to work interactively with input from a terminal keyboard, as the aim is to achieve the results of computation through an immediate dialogue between user and language. Furthermore, to help users who need iterative operation on the same formulae, use of source files is provided and the two input modes can be used in any combination during the session.
Descriptors: *COMPUTER PROGRAMMING LANGUAGES--*Applications; MATHEMATICAL TECHNIQUES--Iterative Methods
Identifiers: COMPUTER LANGUAGE ABACUS
Classification Codes:
723 (Computer Software); 921 (Applied Mathematics)
72 (COMPUTERS & DATA PROCESSING); 92 (ENGINEERING MATHEMATICS)

16/5/20 (Item 1 from file: 35)
DIALOG(R)File 35:Dissertation Abs Online

01695155 ORDER NO: AAD99-22219
ON-LINE MATHEMATICAL EXPRESSION **RECOGNITION USING FLEXIBLE STRUCTURAL MATCHING AND HIERARCHICAL DECOMPOSITION** PARSING
Author: CHAN, KAM-FAI
Degree: PH.D.
Year: 1998
Corporate Source/Institution: HONG KONG UNIV. OF SCI. AND TECH. (PEOPLE'S REPUBLIC OF CHINA) (1223)
Source: VOLUME 60/03-B OF DISSERTATION ABSTRACTS INTERNATIONAL. PAGE 1159. 155 PAGES
Descriptors: COMPUTER SCIENCE
Descriptor Codes: 0984

With the recent advances in pen-based computing technologies, we already have all the necessary hardware to provide an **input** device for entering **mathematical expressions** into computers in a natural way, i.e., we simply write the expressions on an electronic tablet for the computer to recognize them automatically. The key problem that remains is of course the automatic recognition of mathematical expressions, which is more on the software side.

Mathematical expressions are generally two-dimensional structural patterns. They typically consist of special symbols and Greek letters in addition to English letters and digits. Moreover, characters and symbols

may appear in various positions, possibly of different sizes. All these together make the recognition process very complicated even when all the individual characters and symbols can be recognized correctly.

Mathematical expression recognition consists of two major stages: <italic> symbol recognition</italic> and <italic>structural analysis</italic>. Character recognition, as the most common type of symbol recognition problems, has been an active research area for more than three decades. Structural analysis of two-dimensional patterns also has a long history. However, very few papers have addressed specific problems related to mathematical expression recognition.

In this thesis, we tackle various issues related to mathematical expression recognition. In particular, we propose two methods to solve problems in different stages of the recognition process, i.e., <italic>flexible structural matching </italic> for symbol recognition and <italic>hierarchical decomposition parsing </italic> for structural analysis. In addition, we incorporate some error detection and correction mechanisms in both stages so that the overall recognition rate can be improved. To show the effectiveness of the proposed methods, we also suggest some schemes for evaluating recognition performance.

Experiments have been done on 600 mathematical expressions written by 10 writers. The results show that the recognition rates obtained are fairly high and the recognition speed for a single expression ranges from 0.73 second to 6 seconds over different sizes of expressions, with the system running in Prolog on a modest Sun SPARC 10 Unix workstation. This makes mathematical expression recognition more feasible for real-world applications.

16/5/21 (Item 2 from file: 35)

918148 ORDER NO: AAD86-11456

EXTENSIONS TO THE RELATIONAL DATA MODEL MODEL FOR STATISTICAL DATABASE APPLICATIONS (COMPUTERS, QUERY PROCESSING)

Author: MATOS, VICTOR MANUEL
Degree: PH.D.
Year: 1986
Corporate Source/Institution: CASE WESTERN RESERVE UNIVERSITY (0042)
Source: VOLUME 47/03-B OF DISSERTATION ABSTRACTS INTERNATIONAL. PAGE 1149. 197 PAGES
Descriptors: COMPUTER SCIENCE
Descriptor Codes: 0984

In commercial network database management systems, set-valued fields and aggregate functions are commonly supported. However, the relational database model, as defined by Codd, does not include sex-valued attributes or aggregate functions. Recently, Klug extended the relational model by incorporating aggregate functions and by defining relational algebra and calculus languages.

In this thesis, relational calculus database query language (as defined by Klug) is extended to manipulate set-valued attributes and to utilize aggregate functions. The expressive power of the extended language is shown to be equivalent to the extended relational algebra (ERA) of Ozsoyoglu and Ozsoyoglu which includes three new operators, namely, pack, unpack and aggregation-by-template. The extended languages form a theoretical framework for statistical database query languages.

Summary-Table-by-Example (STBE) is a graphical, user friendly language based in the extended relational calculus. STBE, suitable for statistical database applications, permits queries with a hierarchical subquery structure, and manipulates relations with set-valued **attributes** and summary **tables** .

The hierarchical arrangement of STBE queries naturally implies a tuple-by-tuple subquery evaluation strategy (similar to the nested loops join implementation technique) which may not be the best query processing

strategy. In this thesis we discuss the query processing techniques used in STBE. We first convert an STBE **query** into an extended relational **algebra expression** using techniques similar to those proposed for removing the nesting from SQL queries. Two transformations are introduced to remove the hierarchical arrangement of subqueries so that query optimization is possible. To solve the "empty partition" problem of aggregate function evaluation, directional join (one-sided outer-join) is utilized. We then give the algebraic properties of the ERA operators to obtain an "improved" ERA expression. Finally we list alternative access paths and their cost formulas for obtaining an access path with the smallest cost. In addition to revising the access paths from SQL and ABE (Aggregates-By-Example) for STBE, new access paths for the ERA operators pack, unpack, and the aggregate-by-template are presented.

16/5/22 (Item 3 from file: 35)

890472 ORDER NO: AAD85-18098
A MECHANISM FOR NATURAL LANGUAGE DATABASE (ARTIFICIAL INTELLIGENCE)
Author: FEINAUER, RICHARD ALLEN
Degree: PH.D.
Year: 1985
Corporate Source/Institution: UNIVERSITY OF CINCINNATI (0045)
Source: VOLUME 46/06-B OF DISSERTATION ABSTRACTS INTERNATIONAL.
PAGE 1980. 367 PAGES
Descriptors: COMPUTER SCIENCE
Descriptor Codes: 0984

The purpose of this dissertation is to investigate the capabilities of a transportable natural language database query methodology that has only a surface level understanding of the user's query and uses a relational logical schema as the basis of its world model. A secondary goal of this dissertation is to explore the usefulness of explicit optimization techniques in a natural language **database** query methodology.

The basic **features** of the methodology described in this dissertation and implemented in a test system called DRIVER are an Analyzer that converts the user's **query** into a relational **algebra statement** and an Evaluator which converts the relational algebra statement into the data manipulation language of the target database management system and presents the answer to the user. The Analyzer contains five components. They are: a Word Role Identifier, a Phrase Segmenter, a Phrase Analyzer, a Query Generator, and a User Dialog. Each component transforms the query into a form which is closer to the relational **algebra statement** than its **input** . The Analyzer has four external sources of information. They are: a query grammar, a world model, a query complexity measure, and the user. The world model is based on a relational logical schema of the target database domain. The physical database may have any organization provided that a relational schema can be mapped onto it. Both the query grammar and the complexity measure make extensive use of the logical schema.

The investigative methodology was evaluated using 640 test queries. Four hundred and four (63.1%) of those queries were interpreted correctly. One hundred and fourteen (17.9%) of the queries were interpreted substantially correctly (the interpretation was correct but unfriendly or it provided a super set of the desired information). One hundred and twenty two (19.0%) of the queries were not interpreted correctly. Three hundred and thirty three of the 404 correctly interpreted queries and 85 of the 114 substantially correctly interpreted queries had only a single interpretation. For the remaining queries two or more interpretations were produced and the user had to select the correct interpretation.

This dissertation makes contributions to the following aspects of natural language database query research: improved understanding of the capabilities and limitations of methodologies that have only a surface

level understanding of the query, improved understanding of the limitations and capabilities of the logical schema as the basis of a world model, and a demonstration of the usefulness of explicit optimization techniques in natural language research. This dissertation also develops a powerful dis-ambiguation tool called the complexity measure.

16/5/32 (Item 3 from file: 6)
DIALOG(R)File 6:NTIS

0170924 NTIS Accession Number: AD-681 099/XAB
On-Line Parsing **of Hand-Printed** Mathematical Expressions
(Final rept. on Phase 2)
Williams, T. G.
System Development Corp Santa Monica Calif
Corp. Source Codes: 339900
Report No.: SDC-TM-4158/000/00
27 Dec 68 21p
Journal Announcement: USGRDR6906
Order this product from NTIS by: phone at 1-800-553-NTIS (U.S. customers); (703)605-6000 (other countries); fax at (703)321-8547; and email at orders@ntis.fedworld.gov. NTIS is located at 5285 Port Royal Road, Springfield, VA, 22161, USA.
NTIS Prices: PC A02/MF A01
Contract No.: DAHC15-67-C-0149; NAS12-526
This document describes a program that analyzes two-dimensional **mathematical expressions** that have been **input** to a computer. These expressions are hand printed on a RAND Tablet/CRT console, and are processed by a character recognition program which replaces the user's input with machine-generated characters. The two-dimensional structures are converted in a linear string of characters, which is displayed at the top of the writing surface. The input expressions can be edited by the user on line. The linear string of characters can be processed by conventional compilers. (Author)
Descriptors: *Input-output devices; Character recognition; Mathematics; Symbols; Cathode ray tubes; Programming(Computers); Printing; Syntax
Identifiers: Computer graphics; Parsing; RAND tablet input devices; On line systems

22/5/6 (Item 1 from file: 2)
DIALOG(R)File 2:INSPEC

08231029 INSPEC Abstract Number: C2002-05-4210-022
Title: Using max-plus algebra for the evaluation of stochastic process algebra prefixes
Author(s): Cloth, L.; Bohnenkamp, H.; Haverkort, B.
Author Affiliation: Dept. of Comput. Sci., Rheinisch-Westfalische Tech. Hochschule, Aachen, Germany
Conference Title: Process Algebra and Probabilistic Methods. Performance Modelling and Verification. Joint International Workshop, PAPM-PROBMIV 2001. Proceedings (Lecture Notes in Computer Science Vol.2165) p.152-67
Editor(s): de Alfaro, L.; Gilmore, S.
Publisher: Springer-Verlag, Berlin, Germany
Publication Date: 2001 Country of Publication: Germany xii++215 pp.
ISBN: 3 540 42556 X Material Identity Number: XX-2001-02450
Conference Title: Process Algebra and Probabilistic Methods. Performance Modelling and Verification. Joint International Workshop, PAPM-PROBMIV 2001. Proceedings
Conference Sponsor: German Res. Assoc.; IBM Deutschland; Siemens AG Munchen; T-Nova Deutsche Telekom Innovationsgesellschaft; et al
Conference Date: 12-14 Sept. 2001 Conference Location: Aachen, Germany
Language: English Document Type: Conference Paper (PA)
Treatment: Theoretical (T)
Abstract: In this paper, the concept of complete finite **prefixes** for process **algebra expressions** is extended to stochastic models. Events are supposed to happen after a delay that is determined by random variables assigned to the preceding conditions. Max-plus **algebra expressions** are shown to provide an elegant notation for stochastic **prefixes** not containing any decisions. Furthermore, they allow for the computation of performance measures. The derivation of the so called k-th occurrence times is shown in detail. (13 Refs)
Subfile: C
Descriptors: process algebra; stochastic automata
Identifiers: stochastic models; finite prefixes; process algebra; performance measures; stochastic process algebras
Class Codes: C4210 (Formal logic); C4220 (Automata theory)

22/5/11 (Item 6 from file: 2)
DIALOG(R)File 2:INSPEC

01546606 INSPEC Abstract Number: C73019150
Title: Infix to prefix translation: the insufficiency of a pushdown stack
Author(s): Reingold, E.M.
Author Affiliation: Univ. Illinois, Urbana-Champaign, IL, USA
Journal: SIAM Journal on Computing vol.1, no.4 p.350-3
Publication Date: Dec. 1972 Country of Publication: USA
CODEN: SMJCAT ISSN: 0097-5397
Language: English Document Type: Journal Paper (JP)
Treatment: Theoretical (T)
Abstract: The permutations of the input string achievable by an algorithm which uses a single pushdown stack and M random access storage locations are characterized, and the characterization is used to show that no such algorithm can translate **arithmetic expressions** from infix to **prefix.** (6 Refs)
Subfile: C
Descriptors: programming theory
Identifiers: infix to prefix translation; pushdown stack; permutations; input string; algorithm
Class Codes: C4240 (Programming and algorithm theory)

22/5/12 (Item 1 from file: 94)
DIALOG(R)File 94:JICST-EPlus

04902110 JICST ACCESSION NUMBER: 01A0492549 FILE SEGMENT: JICST-E
Translation Rules for Numerical Expressions **with** Prefix **and Suffix.**
NOBUHARA YOSHITAKA (1); IKEHARA SATORU (1); MURAKAMI JIN'ICHI (1)
(1) Tottoridai Daigakuinkogakukenkyuka
Joho Shori Gakkai Kenkyu Hokoku, 2001, VOL.2001,NO.20-(FI-61 NL-142), PAGE.75-82, FIG.9, TBL.3, REF.11
JOURNAL NUMBER: Z0031BAO ISSN NO: 0919-6072
UNIVERSAL DECIMAL CLASSIFICATION: 681.3:80
LANGUAGE: Japanese COUNTRY OF PUBLICATION: Japan
DOCUMENT TYPE: Journal
ARTICLE TYPE: Original paper
MEDIA TYPE: Printed Publication
ABSTRACT: Conventional researches on Japanese to English machine translations have not dealt with the **quantity expressions** with **prefix** and suffix. This paper proposed translation rules for such expressions using the examples extracted from 10,000 sentences of bilingual corpus for newspaper. The rules are described by numerical classifiers, semantic attributes for nouns and effective values for numerals. As the results of having applied the rules to newspaper articles and a test sentence set for Japanese English machine translations, translation accuracy amounts to 70% and 66% for each. (author abst.)
DESCRIPTORS: machine translation; number(mathematics); representation; Japanese; English; semantic analysis; corpus; newspaper
IDENTIFIERS: prefix; suffix
BROADER DESCRIPTORS: automatic language processing; computer application; utilization; information processing; treatment; translation(language); oriental language; natural language; language; western language; serials; publications; resource(document)
CLASSIFICATION CODE(S): JE06000L

22/5/13 (Item 1 from file: 6)
DIALOG(R)File 6:NTIS

1757941 NTIS Accession Number: N93-31534/9
Iterated Quantifiers
Westerstaahl, D.
Amsterdam Univ. (Netherlands). Faculteit der Wiskunde en Informatica.
Corp. Source Codes: 001761005; AU835896
Report No.: LP-92-13; ETN-93-94141
Nov 92 38p
Languages: English
Journal Announcement: GRAI9323; STAR3112
Order this product from NTIS by: phone at 1-800-553-NTIS (U.S. customers); (703)605-6000 (other countries); fax at (703)321-8547; and email at orders@ntis.fedworld.gov. NTIS is located at 5285 Port Royal Road, Springfield, VA, 22161, USA.
NTIS Prices: PC A03/MF A01
Country of Publication: Netherlands
The logic of polyadic quantifiers definable by generalized quantifier prefixes, called iterations, is studied. Besides being of general logical interest, the study is also motivated by the fact that iterations provide a perspicuous way of displaying scope dependencies in formalizations of many **quantified sentences** in natural language. Two results by Keenan on quantifier **prefixes** are presented in a gereralized and global form, and some techniques used in their proofs are made explicit. These techniques are applied to logical definability issues for quantifiers, more precisely to questions as to when certain kinds of polyadic quantifiers are

iterations. Among other things, necessary and sufficient conditions are given for resumption quantifiers, branching quantifiers, and cumulative quantifiers, respectively, to be iterations on finite models.
Descriptors: *Iteration; *Mathematical logic; Theorem proving; Theorems
Identifiers: *Foreign technology; NTISNASAE
Section Headings: 72B (Mathematical Sciences--Algebra, Analysis, Geometry, and Mathematical Logic)

22/5/14 (Item 2 from file: 6)
DIALOG(R)File 6:NTIS

0461772 NTIS Accession Number: AD-785 046/4/XAB
An Algebraic Simplify Program in LISP
Wooldridge, D.
Stanford Univ Calif Dept of Computer Science
Corp. Source Codes: 094120
Sponsor: Advanced Research Projects Agency, Arlington, Va.
Report No.: AI MEMO-11
27 Dec 63 60p
Journal Announcement: GRAI7423
Report on Stanford Artificial Intelligence Project.
Order this product from NTIS by: phone at 1-800-553-NTIS (U.S. customers); (703)605-6000 (other countries); fax at (703)321-8547; and email at orders@ntis.fedworld.gov. NTIS is located at 5285 Port Royal Road, Springfield, VA, 22161, USA.
NTIS Prices: PC A04/MF A01
Contract No.: SD-183
A program which performs 'obvious' (non-controversial) simplifying transformations on **algebraic expressions** (written in LISP **prefix** notation) is described. Cancellation of inverses and consolidation of sums and products are the basic accomplishments of the program; however, if the user desires to do so, he may request the program to perform special tasks, such as collect common factors from products in sums or expand products. (Modified author abstract)
Descriptors: *Computer programming; *Transformations(Mathematics); Algebra; Polynomials; Mathematical logic
Identifiers: LISP 1.5 programming language; IBM 7090 computers; Debugging(Computers); NTISDODSD
Section Headings: 62A (Computers, Control, and Information Theory--Computer Hardware)

22/5/15 (Item 1 from file: 144)
DIALOG(R)File 144:Pascal

15916240 PASCAL No.: 03-0055964
A genetic algorithm for texture description and classification
Visual information processing XI : Orlando FL, 4 April 2002
MANIAN Vidya; VASQUEZ Ramon
RAHMAN Zia-ur, ed; SCHOWENGERDT Robert A, ed; REICHENBACH Stephen E, ed
Electrical and Computer Engineering Department, University of Puerto Rico, Mayagueez Campus, Mayagueez, Puerto Rico 00681-5000, Puerto Rico
International Society for Optical Engineering, Bellingham WA, United States
Visual information processing. Conference, 11 (Orlando FL USA) 2002-04-04
Journal: SPIE proceedings series, 2002, 4736 57-63
ISBN: 0-8194-4486-3 ISSN: 1017-2653 Availability: INIST-21760; 354000108461530070
No. of Refs.: 10 ref.
Document Type: P (Serial); C (Conference Proceedings) ; A (Analytic)
Country of Publication: United States

Language: English
Classification of images requires extraction of optimal set of features. In this paper, a method that uses genetic algorithm creating texture descriptors on features computed from a feature extraction method is presented. A feature extraction algorithm is applied to a **database** of images and a training **feature** matrix is created. This matrix is updated by a dynamic algorithm, which finds the vectors most close to the real solution in the Euclidean norm. This set forms the texture descriptor which can be further used for classification of unknown samples. A weighted fitness function that selects best parents in each generation has been implemented. Examples of classification are presented with the features computed from a classification algorithm. Results show that the classification performance of the features improved after applying the genetic algorithm. The algorithm is cost efficient. This algorithm is also compared with that of the Learning Vector Quantization method which quantizes the training vectors to an optimal set of codebook vectors.

English Descriptors: Image databank; Genetic algorithm; Image texture; Image classification; Pattern recognition; Learning (artificial intelligence); Pattern **extraction** ; Vector **quantization** ; Weight **function** ; Euclidean theory; **Database** ; **Feature extraction** ; **CodebookBa**

French Descriptors: Banque image; Algorithme genetique; Texture image; Classification image; Reconnaissance forme; Apprentissage(intelligence artificielle); Extraction forme; Quantification vectorielle; Fonction poids; Theorie euclidienne; Base donnee; Extraction caracteristique; Table codage

Classification Codes: 001D02C03

22/5/18 (Item 4 from file: 144)
DIALOG(R)File 144:Pascal

12071791 PASCAL No.: 95-0272360
MathProbe active mathematical dictionary
Intelligent multimedia information retrieval systems and management : New York NY, October 11-12, 1994
WATTERS C; HO J
Acadia univ., Jodrey school computer sci., Wolfville NS, Canada
Centre de hautes etudes internationales d'informatique documentaire, France.; Center for Advanced Study of Information Systems, Terra incognita.
RIAO 94 : recherche d'information assistee par ordinateur. Conference (New York Ny USA) 1994-10-11
1994 552-569
Publisher: CID, Paris
Availability: INIST-Y 30633; 354000042659560395
No. of Refs.: 16 ref.
Document Type: C (Conference Proceedings) ; A (Analytic)
Country of Publication: France
Language: English
In this paper we wil discuss our work using a grammar to extend the structural definition of dictionary entries to include mathematical expressions. The understanding and definition of structure of mathematical expressions provides an additional level of power to online mathematical dictionaries. MathProbe is a prototype "active" dictionary that provides interactive browsing and computation **features** for a **dictionary** of mathematical terms. The prototype dictionary uses xdvi as the display engine and Maple as the computation engine. The user can browse and read entries in the dictionary and execute instances of expressions used inthose

entreis to assist, by example, understanding of the difinitions or in th ecourse of related activities of the user

English Descriptors: Automatic dictionary; Textual data; Automated processing; Data structure; Mathematics; Coding; Context free grammar; Language processing; Text; Automatic recognition; Information **extraction** ; Information conversion; Data processing; Display; Implementation; Prototype; **Mathematical expression**
Broad Descriptors: Editorial data processing; Informatique edition

27/5/11 (Item 3 from file: 35)
DIALOG(R)File 35:Dissertation Abs Online

890472 ORDER NO: AAD85-18098
A MECHANISM FOR NATURAL LANGUAGE **DATABASE (ARTIFICIAL INTELLIGENCE)**
Author: FEINAUER, RICHARD ALLEN
Degree: PH.D.
Year: 1985
Corporate Source/Institution: UNIVERSITY OF CINCINNATI (0045)
Source: VOLUME 46/06-B OF DISSERTATION ABSTRACTS INTERNATIONAL.
PAGE 1980. 367 PAGES
Descriptors: COMPUTER SCIENCE
Descriptor Codes: 0984

The purpose of this dissertation is to investigate the capabilities of a transportable **natural language** database query methodology that has only a surface level understanding of the user's query and uses a relational logical schema as the basis of its world model. A secondary goal of this dissertation is to explore the usefulness of explicit optimization techniques in a **natural language database** query methodology.

The basic **features** of the methodology described in this dissertation and implemented in a test system called DRIVER are an Analyzer that converts the user's query into a relational **algebra statement** and an Evaluator which converts the relational **algebra statement** into the data manipulation language of the target database management system and presents the answer to the user. The Analyzer contains five components. They are: a Word Role Identifier, a Phrase Segmenter, a Phrase Analyzer, a Query Generator, and a User Dialog. Each component transforms the query into a form which is closer to the relational **algebra statement** than its input. The Analyzer has four external sources of information. They are: a query grammar, a world model, a query complexity measure, and the user. The world model is based on a relational logical schema of the target database domain. The physical database may have any organization provided that a relational schema can be mapped onto it. Both the query grammar and the complexity measure make extensive use of the logical schema.

The investigative methodology was evaluated using 640 test queries. Four hundred and four (63.1%) of those queries were interpreted correctly. One hundred and fourteen (17.9%) of the queries were interpreted substantially correctly (the interpretation was correct but unfriendly or it provided a super set of the desired information). One hundred and twenty two (19.0%) of the queries were not interpreted correctly. Three hundred and thirty three of the 404 correctly interpreted queries and 85 of the 114 substantially correctly interpreted queries had only a single interpretation. For the remaining queries two or more interpretations were produced and the user had to select the correct interpretation.

This dissertation makes contributions to the following aspects of **natural language** database query research: improved understanding of the capabilities and limitations of methodologies that have only a surface level understanding of the query, improved understanding of the limitations and capabilities of the logical schema as the basis of a world model, and a demonstration of the usefulness of explicit optimization techniques in **natural language** research. This dissertation also develops a powerful dis-ambiguation tool called the complexity measure.

27/5/14 (Item 1 from file: 94)
DIALOG(R)File 94:JICST-EPlus

06337692 JICST ACCESSION NUMBER: 06A0317895 FILE SEGMENT: JICST-E
A Study on Character Recognition Error Correction Method for Mathematical Formulae using Higher Level Information
TAKIGUCHI YUSUKE (1); OKADA MINORU (1); MIYAKE YASUJI (2)

(1) Waseda Univ., Graduate School of Information, Production and Systems, JPN; (2) Chubu Univ., Fac. of Eng.
Denshi Joho Tsushin Gakkai Gijutsu Kenkyu Hokoku(IEIC Technical Report (Institute of Electronics, Information and Communication Engineers), 2006, VOL.105,NO.673(PRMU2005 233-258), PAGE.107-112, FIG.8, TBL.4, REF.8
JOURNAL NUMBER: S0532BBG ISSN NO: 0913-5685
UNIVERSAL DECIMAL CLASSIFICATION: 681.3:165
LANGUAGE: Japanese COUNTRY OF PUBLICATION: Japan
DOCUMENT TYPE: Journal
ARTICLE TYPE: Original paper
MEDIA TYPE: Printed Publication
ABSTRACT: In this paper we propose a method for correcting character recognition errors at the higher level recognition step of the mathematical formulae recognition and understanding system. The system consists of two-level recognition steps: the low level recognition including character recognition, and the higher level recognition including layout recognition. We apply the layout information recognized in the latter step, and character recognition errors are corrected by using two sources of information. One is by some keywords such as **mathematical function** names, and the other is based on a cost tree and **co - occurrence** probabilities between symbols. Availability of the proposed method is indicated by some experimental results, and the character recognition rate raised from 79.8% to 90.2% and the formula recognition rate raised from 5.8% to 41.1% are confirmed. (author abst.)

33/5/12 (Item 12 from file: 8)
DIALOG(R)File 8:Ei Compendex(R)

04861877 E.I. No: EIP97103899657
Title: Optical Formula Recognition
Author: Lavirotte, Stephane; Pottier, Loic
Corporate Source: INRIA Sophia Antipolis, Sophia-Antipolis, Fr
Conference Title: Proceedings of the 1997 4th International Conference on Document Analysis and Recognition, ICDAR'97. Part 1 (of 2)
Conference Location: Ulm, Ger Conference Date: 19970818-19970820
Sponsor: IEEE
E.I. Conference No.: 47157
Source: Proceedings of the International Conference on Document Analysis and Recognition, ICDAR v 1 1997. IEEE, Los Alamitos, CA, USA,97TB100138. p 357-361
Publication Year: 1997
CODEN: 002693
Language: English
Document Type: CA; (Conference Article) Treatment: T; (Theoretical)
Journal Announcement: 9712W4
Abstract: This paper describes the design and the first steps of implementation of Ofr (Optical **Formula Recognition**), a system for **extracting** and understanding **mathematical expressions** in printed documents. Our approach clearly separate OCR step, geometrical treatments and syntactic analysis. In this paper we focus on the third part: we define a class of context-sensitive graph grammars for mathematical formulas, study their properties and show how to remove their ambiguities (by adding contexts in rules) to define efficient parsing. This method is based on a `critical pairs' approach in the sense of Knuth-Bendix algorithm. (Author abstract) 14 Refs.
Descriptors: *Optical character recognition; Image analysis; Algorithms
Identifiers: Optical **formula recognition** (OFR)
Classification Codes:
741.1 (Light/Optics); 723.2 (Data Processing)
741 (Optics & Optical Devices); 723 (Computer Software); 921 (Applied Mathematics)
74 (OPTICAL TECHNOLOGY); 72 (COMPUTERS & DATA PROCESSING); 92 (ENGINEERING MATHEMATICS)

33/5/14 (Item 14 from file: 8)
DIALOG(R)File 8:Ei Compendex(R)

04715208 E.I. No: EIP97063684063
Title: Design of a mathematical expression understanding system
Author: Lee, Hsi-Jian; Wang, Jiumn-Shine
Corporate Source: Natl Chiao Tung Univ, Hsinchu, Taiwan
Source: Pattern Recognition Letters v 18 n 3 Mar 1997. p 289-298
Publication Year: 1997
CODEN: PRLEDG ISSN: 0167-8655
Language: English
Document Type: JA; (Journal Article) Treatment: A; (Applications)
Journal Announcement: 9707W5
Abstract: A scientific document usually consists of text and mathematical expressions. In this paper, we present a system for segmenting and understanding text and mathematical expressions in a document. The system can be divided into six stages: page segmentation and labelling, character segmentation, feature extraction, character recognition, expression formation, and error correction and expression extraction. After we extract all text lines in a document, we separate all symbols in each text line and calculate direction-feature vectors and aspect ratios for those symbols. Then, a nearest-neighbor algorithm recognizes characters. In the expression formation stage, we build a symbol relation tree for each text line that

represents the relationships among the symbols in the text line. Each text line is decomposed into a collection of primitive tokens: operands, operators and separators. Heuristic rules based on these primitive tokens are used to correct text **recognition** errors. Finally, we **extract** all **mathematical expressions** according to basic expression forms. Several pages of documents were scanned to test the method. All mathematical expressions are understood. In the expressions generated, a few symbols are misrecognized. The average recognition rate was 96.16%. (Author abstract) 5 Refs.

Descriptors: *Character recognition; Optical character recognition; Image segmentation; Feature extraction; Error correction; Mathematical models; Codes (symbols); Algorithms

Identifiers: Mathematical expression; Page segmentation; Character segmentation; Expression formation

Classification Codes:

723.2 (Data Processing); 741.1 (Light/Optics); 721.1 (Computer Theory, Includes Formal Logic, Automata Theory, Switching Theory, Programming Theory); 921.6 (Numerical Methods)

723 (Computer Software); 741 (Optics & Optical Devices); 721 (Computer Circuits & Logic Elements); 921 (Applied Mathematics)

72 (COMPUTERS & DATA PROCESSING); 74 (OPTICAL TECHNOLOGY); 92 (ENGINEERING MATHEMATICS)

33/5/17 (Item 1 from file: 2)

DIALOG(R)File 2:INSPEC

09389283 INSPEC Abstract Number: C2005-06-1250B-012

Title: Recognition **of online handwritten** mathematical expressions

Author(s): Ohta, K.; Yokota, H.

Journal: Bulletin of Hiroshima Institute of Technology Research Volume vol.39 p.369-74

Publisher: Hiroshima Inst. Technol,

Publication Date: Feb. 2005 Country of Publication: Japan

ISSN: 1346-9975

SICI: 1346-9975(200502)39L.369:ROHM;1-1

Material Identity Number: J729-2005-001

Language: Japanese Document Type: Journal Paper (JP)

Treatment: Practical (P); Theoretical (T)

Abstract: This paper describes our methods about online handwritten **mathematical expression recognition**, which is composed of mathematical character recognition, mathematical structure analysis, and mathematical contents analysis. This paper also explains how to present **recognized mathematical expression**. We have tried to improve our node-dividing method developed last year in order to **obtain** the better **mathematical** expression recognition rate. To **obtain** the better mathematical character recognition, we have analyzed mathematical characters by their strokes and developed an efficient way of cutting each mathematical character out of mathematical expression. It turns out that this method also enables us to include the square root notation for online recognition. For mathematical structure analysis, we have added the inclusion relation to take care of square root notation. We have included experimental results using **mathematical expression recognition** software we developed which has a potential of creating a new way of learning mathematics. (8 Refs)

Subfile: C

Descriptors: document image processing; handwritten character recognition

Identifiers: online handwritten character recognition; **mathematical expression recognition** software; mathematical character recognition; mathematical structure analysis; mathematical content analysis; square root notation; document image processing

Class Codes: C1250B (Character recognition); C6130D (Document processing techniques); C5260B (Computer vision and image processing techniques)

33/5/18 (Item 2 from file: 2)
DIALOG(R)File 2:INSPEC

07957663 INSPEC Abstract Number: C2001-07-5260B-347
Title: On-line recognition of mathematical expressions using automatic rewriting method
Author(s): Kanahori, T.; Tabata, K.; Cong, W.; Tamari, F.; Suzuki, M.
Author Affiliation: Graduate Sch. of Math., Kyushu Univ., Fukuoka, Japan
Conference Title: Advances in Multimodal Interfaces-ICMI 2000. Third International Conference (Lecture Notes in Computer Science Vol.1948) p. 394-401
Editor(s): Tan, T.; Shi, Y.; Gao, W.
Publisher: Springer Verlag, Berlin, Germany
Publication Date: 2000 Country of Publication: Germany xv+678 pp.
ISBN: 3 540 41180 1 Material Identity Number: XX-2001-00248
Conference Title: Advances in Multimodal Interfaces - ICMI 2000. Third International Conference. Proceedings
Conference Date: 14-16 Oct. 2000 Conference Location: Beijing, China
Language: English Document Type: Conference Paper (PA)
Treatment: Practical (P)
Abstract: The paper describes a system of online **recognition** of **mathematical expressions** . Users can **input mathematical expressions** by handwriting. As soon as a character is written, it is rewritten by neat strokes in an appropriate position and size automatically. This Automatic Rewriting Method improves the accuracy of the structure analysis of the written mathematical expressions. The written mathematical expressions can be output into files in the notation of LATEX and MathML. By using this handwriting interface, the system realizes very easy intuitive methods to **input mathematical expressions** into the computer. (4 Refs)
Subfile: C
Descriptors: handwriting recognition; handwritten character recognition; mathematics computing; natural language interfaces; page description languages
Identifiers: **mathematical expression recognition** ; automatic rewriting method; online recognition; neat strokes; structure analysis; written mathematical expressions; LATEX; MathML; handwriting interface; intuitive methods
Class Codes: C5260B (Computer vision and image processing techniques); C1250B (Character recognition); C6130D (Document processing techniques); C6180N (Natural language processing); C7310 (Mathematics computing)

33/5/20 (Item 4 from file: 2)
DIALOG(R)File 2:INSPEC

07639139 INSPEC Abstract Number: B2000-08-6135E-088, C2000-08-5260B-216
Title: An approach for recognition and interpretation of mathematical expressions in printed document
Author(s): Chaudhuri, B.B.; Garain, U.
Author Affiliation: Comput. Vision & Pattern Recognition Unit, Indian Stat. Inst., Calcutta, India
Journal: Pattern Analysis and Applications vol.3, no.2 p.120-31
Publisher: Springer-Verlag,
Publication Date: 2000 Country of Publication: UK
CODEN: PPAAF5 ISSN: 1433-7541
SICI: 1433-7541(2000)3:2L.120:ARIM;1-G
Material Identity Number: H235-2000-002
U.S. Copyright Clearance Center Code: 1433-7541/2000/$2.00+0.20
Language: English Document Type: Journal Paper (JP)
Treatment: Practical (P); Experimental (X)

Abstract: We propose an approach for understanding mathematical expressions (MEs) in a printed document. The system is divided into three main components: (i) detection of MEs in a document; (ii) recognition of the symbols present in each ME; and (iii) arrangement of the recognised symbols. The MEs printed in separate lines are detected without any character recognition whereas the embedded expressions (mixed with normal text) are detected by recognising the mathematical symbols in text. Some structural features of the MEs are used for both cases. The mathematical symbols are grouped into two classes for convenience. At first, the frequently occurring symbols are recognised by a stroke-feature analysis technique. Recognition of less frequent symbols involves a hybrid of feature based and template based technique. The bounding-box coordinates and the size information of the symbols help to determine the spatial relationships among the symbols. A set of predefined rules is used to form the meaningful symbol groups so that a logical arrangement of the **mathematical expression** can bet **obtained** . Experiments conducted using this approach on a large number of documents show high accuracy. (25 Refs)

Subfile: B C

Descriptors: document image processing; optical character recognition

Identifiers: mathematical expression; printed document; embedded expressions; mathematical symbols; structural features; stroke-feature analysis technique; template based technique; feature based technique; spatial relationships

Class Codes: B6135E (Image recognition); C5260B (Computer vision and image processing techniques)

33/5/21 (Item 5 from file: 2)

07481381 INSPEC Abstract Number: C2000-03-1250B-003

Title: An efficient syntactic approach to structural analysis of online handwritten mathematical expressions

Author(s): Kam-Fai Chan; Dit-Yan Yeung

Author Affiliation: Dept. of Comput. Sci., Hong Kong Univ. of Sci. & Technol., Kowloon, Hong Kong

Journal: Pattern Recognition vol.33, no.3 p.375-84

Publisher: Elsevier,

Publication Date: March 2000 Country of Publication: UK

CODEN: PTNRA8 ISSN: 0031-3203

SICI: 0031-3203(200003)33:3L.375:ESAS;1-6

Material Identity Number: P133-2000-001

U.S. Copyright Clearance Center Code: 0031-3203/2000/$20.00

Document Number: S0031-3203(99)00067-9

Language: English Document Type: Journal Paper (JP)

Treatment: Experimental (X)

Abstract: Machine **recognition** of **mathematical expressions** is not trivial even when all the individual characters and symbols in an expression can be recognized correctly. In this paper, we propose to use the definite clause grammar (DCG) as a formalism to define a set of replacement rules for **parsing mathematical expressions** . With DCG, we are not only able to define the replacement rules concisely, but their definitions are also in a readily executable form. However, a DCG parser is potentially inefficient due to its frequent use of backtracking. Thus, we propose some methods to increase the efficiency of the **parsing** process. Experiments done on some commonly seen **mathematical expressions** show that our proposed methods can achieve quite satisfactory speedup, making **mathematical expression recognition** more feasible for real-world applications. (28 Refs)

Subfile: C

Descriptors: grammars; handwritten character recognition; real-time systems

Identifiers: handwritten mathematical expressions; definite clause

grammar; character recognition; document processing; structural analysis; real time systems
Class Codes: C1250B (Character recognition); C5260B (Computer vision and image processing techniques); C4210L (Formal languages and computational linguistics)

33/5/23 (Item 7 from file: 2)
DIALOG(R)File 2:INSPEC

07352810 INSPEC Abstract Number: C1999-10-5260B-530
Title: A technique of mathematical expression **structure analysis for the handwriting** input **system**
Author(s): Fukuda, R.; Sou, I.; Tamari, F.
Author Affiliation: Fac. of Eng., Oita Univ., Japan
Conference Title: Proceedings of the Fifth International Conference on Document Analysis and Recognition. ICDAR '99 (Cat. No.PR00318) p.131-4
Publisher: IEEE Comput. Soc, Los Alamitos, CA, USA
Publication Date: 1999 Country of Publication: USA xxiv+821 pp.
ISBN: 0 7695 0318 7 Material Identity Number: XX-1999-02326
U.S. Copyright Clearance Center Code: 0 7695 0318 7/99/$10.00
Conference Title: Proceedings of the Fifth International Conference on Document Analysis and Recognition
Conference Sponsor: Int. Assoc. for Pattern Recognition
Conference Date: 20-22 Sept. 1999 Conference Location: Bangalore, India
Language: English Document Type: Conference Paper (PA)
Treatment: Practical (P)
Abstract: We propose a new practical user interface to **input mathematical expressions** into a computer using a data tablet or an electron board. The system **recognizes mathematical expressions** of high school level (until the first year of university), and the results are output in LATEX-source format. For the character recognition, we use a 3*5-mesh directional element feature and some additional features which are robust against the distortion. As for the segmentation of characters and the structure analysis of mathematical expressions, our method is considerably robust against the touching of characters and the deviation of positions in the wide range. (11 Refs)
Subfile: C
Descriptors: document image processing; handwritten character recognition ; optical character recognition; user interfaces
Identifiers: mathematical expression structure analysis; handwriting input system; user interface; data tablet; LATEX; character recognition; character segmentation; handwriting recognition
Class Codes: C5260B (Computer vision and image processing techniques); C1250B (Character recognition); C6130D (Document processing techniques)

33/5/24 (Item 8 from file: 2)
DIALOG(R)File 2:INSPEC

07103857 INSPEC Abstract Number: C9901-7310-019
Title: Towards efficient structural analysis of mathematical expressions
Author(s): Kam-Fai Chan; Dit-Yan Yeung
Author Affiliation: Dept. of Comput. Sci., Hong Kong Univ. of Sci. & Technol., Hong Kong
Conference Title: Advances in Pattern Recognition. Joint IAPR International Workshops SSPR'98 and SPR'98. Proceedings p.437-44
Editor(s): Amin, A.; Dori, D.; Pudil, P.; Freeman, H.
Publisher: Springer-Verlag, Berlin, Germany
Publication Date: 1998 Country of Publication: Germany xxii+1047 pp.

ISBN: 3 540 64858 5 Material Identity Number: XX98-02192
Conference Title: Advances in Pattern Recognition. Joint IAPR International Workshops. SSPR'98 and SPR'98. Proceedings
Conference Sponsor: Univ. New South Wales; Int. Assoc. Pattern Recognition
Conference Date: 11-13 Aug. 1998 Conference Location: Sydney, NSW, Australia
Language: English Document Type: Conference Paper (PA)
Treatment: Practical (P); Experimental (X)
Abstract: Machine **recognition** of **mathematical expressions** is not trivial even when all the individual characters and symbols in an expression can be recognized correctly. In this paper, we propose to use the definite clause grammar (DCG) as a formalism to define a set of replacement rules for **parsing mathematical expressions** . With DCG, we are not only able to define the replacement rules concisely, but their definitions are also in a readily executable form. However, backtracking parsers like Prolog interpreters, which execute DCG directly, are by nature inefficient. Thus, we propose some methods to increase the efficiency of the **parsing** process. Experiments done on some typical **mathematical expressions** show that our proposed methods can achieve speedups ranging from 10 to 70 times, making **mathematical expression recognition** more feasible for real-world applications. (12 Refs)
Subfile: C
Descriptors: backtracking; computer aided analysis; document image processing; grammars; image recognition; mathematics computing; symbol manipulation
Identifiers: structural analysis; **mathematical expression recognition** ; machine recognition; characters; symbols; definite clause grammar; replacement rules; parsing; executable definitions; backtracking parsers; Prolog interpreters; efficiency; speedup; document processing
Class Codes: C7310 (Mathematics computing); C5260B (Computer vision and image processing techniques); C6130D (Document processing techniques); C4210L (Formal languages and computational linguistics)

33/5/25 (Item 9 from file: 2)
DIALOG(R)File 2:INSPEC

06637728 INSPEC Abstract Number: C9708-6130D-065
Title: Design of a mathematical expression recognition **system**
Author(s): Hsi-Jian Lee; Jiumn-Shine Wang
Author Affiliation: Dept. of Comput. Sci. & Inf. Eng., Nat. Chiao Tung Univ., Hsinchu, Taiwan
Conference Title: Proceedings of the Third International Conference on Document Analysis and Recognition Part vol.2 p.1084-7 vol.2
Publisher: IEEE Comput. Soc. Press, Los Alamitos, CA, USA
Publication Date: 1995 Country of Publication: USA 2 vol. xxvi+1188 pp.
ISBN: 0 8186 7128 9 Material Identity Number: XX97-01463
U.S. Copyright Clearance Center Code: 0 8186 7128 9/95/$4.00
Conference Title: Proceedings of 3rd International Conference on Document Analysis and Recognition
Conference Sponsor: IAPR TC-11, TC-10; Canadian Image Process. & Pattern Recognition Soc.; Centre for Pattern Recognition & Machine Intelligence; IEEE, Sect. Montreal; Lab. Scribens; Int. Graphonomics Soc.; Centre de res. inf. Montreal; Inst. Robotics & Intelligence Syst
Conference Date: 14-16 Aug. 1995 Conference Location: Montreal, Que., Canada
Language: English Document Type: Conference Paper (PA)
Treatment: Practical (P)
Abstract: We present a system to segment and **recognize** texts and **mathematical expressions** in a document. The system can be divided into six stages: page segmentation and labeling, character segmentation, feature

extraction, character recognition, expression formation, and error correction and expression extraction. In expression formation, we build a symbol relation tree for each text line to represent the relationships among the symbols in the text line. Some heuristic rules based on the primitive tokens are used to correct the recognition errors in a text line. We **extract** all **mathematical expressions** according to some basic expression forms. Our database consists of 190 symbols in the current stage. The average recognition rate is about 96.16%. (4 Refs)
Subfile: C
Descriptors: character recognition; document image processing; feature extraction; image segmentation
Identifiers: **mathematical expression recognition** ; mathematical expressions; page segmentation; labeling; character segmentation; feature extraction; heuristic rules; scientific documents; mathematical equations understanding
Class Codes: C6130D (Document processing techniques); C5260B (Computer vision and image processing techniques); C1250B (Character recognition)

33/5/33 (Item 3 from file: 94)
DIALOG(R)File 94:JICST-EPlus

05778692 JICST ACCESSION NUMBER: 04A0386564 FILE SEGMENT: JICST-E
Recognition **of Structure of** Mathematical Expressions **in a Document.**
TAKEUCHI TOMOYUKI (1); OGAWA KOICHI (1)
(1) Hosei Univ., Graduate School of Engineering, JPN
Housei Daigaku Keisan Kagaku Kenkyu Senta Kenkyu Hokoku(Bulletin of Computational Science Research Center, Hosei University), 2004, VOL.17, PAGE.85-89, FIG.8, REF.3
JOURNAL NUMBER: L0821ABN ISSN NO: 1347-6726
UNIVERSAL DECIMAL CLASSIFICATION: 681.3:165 681.3:621.397.3
LANGUAGE: Japanese COUNTRY OF PUBLICATION: Japan
DOCUMENT TYPE: Journal
ARTICLE TYPE: Original paper
MEDIA TYPE: Printed Publication
ABSTRACT: This paper proposes a new method for **recognizing** a structure of **mathematical expressions** in a document. This **recognition** method is based on the location of symbols which appear in the **mathematical expression** . The newly developed algorithm was tested by means of samples **extracted** from a textbook and the accuracy of recognition was evaluated. (author abst.)
DESCRIPTORS: pattern recognition; document image; formula; document; location problem; positioning; system design
IDENTIFIERS: conformational recognition; mathematical formula
BROADER DESCRIPTORS: recognition; image; resource(document); problem; design
CLASSIFICATION CODE(S): JE07000S; JE04010I

33/5/35 (Item 5 from file: 94)
DIALOG(R)File 94:JICST-EPlus

05595213 JICST ACCESSION NUMBER: 03A0675467 FILE SEGMENT: JICST-E
On-line Handwriting Recognition **System for** Mathematical Expression **corresponding to MathML**
KOBAYASHI KAZUMA (1); NISHIMORI KATSUMI (1); NISHIMURA RYO (1); ISHIHARA NAGANORI (1)
(1) Tottori Univ., Fac. of Eng.
Faji Shisutemu Shinpojiumu Koen Ronbunshu, 2003, VOL.19th, PAGE.271-274, FIG.5, TBL.2, REF.3
JOURNAL NUMBER: L0486AAL ISSN NO: 1341-9080
UNIVERSAL DECIMAL CLASSIFICATION: 681.3:165

LANGUAGE: Japanese COUNTRY OF PUBLICATION: Japan
DOCUMENT TYPE: Conference Proceeding
ARTICLE TYPE: Short Communication
MEDIA TYPE: Printed Publication
ABSTRACT: A new **mathematical expression recognition** system which can **input** mathematical characters and equations using on-line writing pen and carry out automatic format generation of the XML file constructed by MathML has been developed. By this research, in order to **recognize** the **mathematical expression** with more complicated structure, this system was found to be useful for laboratory use. (author abst.)
DESCRIPTORS: handwritten character recognition; segmentation(computer); feature extraction; online processing; performance evaluation; WWW(communication); user interface; formula
IDENTIFIERS: MathML; mathematical formula; suffix; recognition rate
BROADER DESCRIPTORS: character recognition; figure pattern recognition; pattern recognition; recognition; extraction; separation; treatment; evaluation; information system; computer application system; system; interface
CLASSIFICATION CODE(S): JE07000S

33/5/36 (Item 6 from file: 94)
DIALOG(R)File 94:JICST-EPlus

05428049 JICST ACCESSION NUMBER: 03A0321042 FILE SEGMENT: JICST-E
Classifying the Japanese Punctuation Mark 'Touten' for Recognition **of** Numerical Expressions **in Newspaper Articles.**
KOBAYASHI NOBUYUKI (1); KIMURA HIROSHI (2); SHIINA HIROMITSU (2)
(1) Okayamaridai Daigakuinrigakukenkyuka; (2) Okayama Univ. Sci., Faculty of Informatics, JPN
Okayama Rika Daigaku Kiyo. A. Shizen Kagaku(Bulletin of the Okayama University of Science. A. Natural Science), 2002, NO.38, PAGE.141-147, FIG.2, TBL.2, REF.3
JOURNAL NUMBER: S0525BAJ ISSN NO: 0285-7685
UNIVERSAL DECIMAL CLASSIFICATION: 681.3:80
LANGUAGE: Japanese COUNTRY OF PUBLICATION: Japan
DOCUMENT TYPE: Journal
ARTICLE TYPE: Original paper
MEDIA TYPE: Printed Publication
ABSTRACT: We can now access a huge corpus such as Japanese newspaper articles through WWW or other media. However, it is difficult to **retrieve** items including **numerical expressions** , for example, "personal computers 100,000 yen or less", because identical expressions do not always have unique meaning. In this paper, we propose a method to recognize the meanings of one type of Japanese punctuation mark, 'Touten', which is used in various kinds of numerical expressions. Our concern is restricted to Japanese newspaper articles as the Touten notation is the most popular notation used. We classify the meanings of Touten into five categories and propose an algorithm to convert numerical expressions including Touten into numerical values with a set of attributes to specify the meaning of values. We obtained good recognition rates in computer experiments using the proposed algorithm. (author abst.)
DESCRIPTORS: language understanding; automatic classification; numerical value; automatic language processing; part of speech; newspaper; tree(graph); accuracy
IDENTIFIERS: newspaper article; comma; classificaton accuracy
BROADER DESCRIPTORS: understanding; classification; computer application; utilization; information processing; treatment; serials; publications; resource(document); subgraph; graph; degree
CLASSIFICATION CODE(S): JE06000L

33/5/37 (Item 7 from file: 94)

DIALOG(R)File 94:JICST-EPlus

05071095 JICST ACCESSION NUMBER: 02A0190967 FILE SEGMENT: JICST-E
Stroke Data Collection and Evaluation of Character Recognition Performance **for our On-line Handwriting** Mathematical Expression Input.
FENG X Y (1); SHIIBA K (1); OKAZAKI Y (1); KONDO H (1); OKAMOTO M (2)
(1) Saga Univ., Saga, Jpn; (2) Sanyo Electric Co. Ltd., Osaka, Jpn
Denshi Joho Tsushin Gakkai Gijutsu Kenkyu Hokoku(IEIC Technical Report (Institute of Electronics, Information and Communication Enginners), 2001, VOL.101,NO.506(ET2001 65-82), PAGE.37-42, FIG.10, TBL.3, REF.7
JOURNAL NUMBER: S0532BBG
UNIVERSAL DECIMAL CLASSIFICATION: 681.3:165
LANGUAGE: English COUNTRY OF PUBLICATION: Japan
DOCUMENT TYPE: Journal
ARTICLE TYPE: Original paper
MEDIA TYPE: Printed Publication
ABSTRACT: In this paper, we present the stroke data collection for on-line handwriting **mathematical expression recognition** , the customized **recognition** dictionaries that use these collected stoke data, and the evaluation experiment for character recognition performance. The stroke data collection interface is Java based. Up to now, we have collected 91 characters (digits, alphabets, Greek letters and some mathematical symbols) from 19 participants. From the result of evaluation experiment, the recognition rate is 79% for all characters (symbols) and 90% for restricted characters (34 characters used in high school algebra). (author abst.)
DESCRIPTORS: handwritten character recognition; formula manipulation; online processing; data collection system; translation dictionary; user interface; client server system; error rate; system evaluation; formula ; pixel
IDENTIFIERS: mathematical formula; stroke(character); Java
BROADER DESCRIPTORS: character recognition; figure pattern recognition; pattern recognition; recognition; information processing; treatment; computer application system; system; dictionary; book; publications; resource(document); interface; computer system(hardware); ratio; evaluation; image
CLASSIFICATION CODE(S): JE07000S

33/5/42 (Item 12 from file: 94)
DIALOG(R)File 94:JICST-EPlus

02360022 JICST ACCESSION NUMBER: 95A0334369 FILE SEGMENT: JICST-E
Mathematical Expression Recognition **by the Layout of Symbols.**
OKAMOTO MASAYUKI (1); HIGASHI HIROYUKI (1)
(1) Shinshu Univ., Fac. of Eng.
Denshi Joho Tsushin Gakkai Ronbunshi. D,2(Transactions of the Institute of Electronics, Information and Communication Engineers. D-2), 1995, VOL.78,NO.3, PAGE.474-482, FIG.6, TBL.1, REF.7
JOURNAL NUMBER: L0197AAM ISSN NO: 0915-1923
UNIVERSAL DECIMAL CLASSIFICATION: 681.3:165
LANGUAGE: Japanese COUNTRY OF PUBLICATION: Japan
DOCUMENT TYPE: Journal
ARTICLE TYPE: Original paper
MEDIA TYPE: Printed Publication
ABSTRACT: It is desirable that not only letters in the document but also tables and mpathematical expressions are converted into an appropriate form, so that a machine can read them out. This is a point of achieving a reading-out system for scientific, technical documants. This paper describes a technique to read mathematical expressions in a printing document. Two-dimensional configuration of symbols is very important for a methematical expression. It is not possible to read out the symbols in a simple one-dimensional way, as taken for usual

sentences. To help understanding of the methematical expression, this paper presents a combination of the following processing methods : A bottom-up approach called "individual structure processing" to the partia connections among symbols. A top-down approach called "basic structure processing" to cover rough structure of methematical expressions. The structure of the **mathematical expression recognized** by this technique is expressed as a tree structure, and teh base mathematical expression can be presented by formatters such as TEX.Images of **mathematical expressions** with various structures were **extracted** from some magazines by an experiment to verify effectiveness of this technique.
DESCRIPTORS: layout; word processing; tree structure; data management; pretreatment; symbol; structure analysis; symbol processing; pattern recognition; normalization; formula; image; document image
BROADER DESCRIPTORS: computer application; utilization; information processing; treatment; structure; management; analysis; recognition; modification
CLASSIFICATION CODE(S): JE07000S

33/5/43 (Item 13 from file: 94)
DIALOG(R)File 94:JICST-EPlus

01805802 JICST ACCESSION NUMBER: 93A0539195 FILE SEGMENT: JICST-E
Prototyping of METAH, A Recognition **system for On-line Handwritten** Mathematical Expressions.
MURASE ATSUSHI (1); SATO TAKASHI (1); NAKAGAWA MASAKI (1)
(1) Tokyo Univ. of Agriculture and Technology, Graduate School
Joho Shori Gakkai Kenkyu Hokoku, 1993, VOL.93,NO.35(HI-48), PAGE.25-32, FIG.14, REF.14
JOURNAL NUMBER: Z0031BAO ISSN NO: 0919-6072
UNIVERSAL DECIMAL CLASSIFICATION: 681.3:165
LANGUAGE: Japanese COUNTRY OF PUBLICATION: Japan
DOCUMENT TYPE: Journal
ARTICLE TYPE: Original paper
MEDIA TYPE: Printed Publication
ABSTRACT: This paper describes the design of user interfaces(UI), and pattern processing and recognition methods for an on-line recognition system "METAH" for the **input** of **mathematical expressions** by handwriting. **Mathematical expressions** possess geometrical information that expresses their structures. Handwriting is thus suitable for inputting such objects. However, pattern recognition entails misrecognition and rejection. Well designed UI's are as essential to the system as high recognition rates. Based on the fact that handwriting does not interrupt creative thinking, this paper presents UI's for the creative **input** of **mathematical expressions** . In contrast to the creative **input** , the design of UI's for their copy input is also discussed. As for the **recognition** processing, the prototype system partitions **mathematical expressions** into symbol patterns, identifies each symbol, recognizes their positional relationships and then parses them. (author abst.)
DESCRIPTORS: word processing; formula; handwritten character recognition; numerical character; symbol; online processing; user interface; human interface; man-machine system; tablet(computer)
BROADER DESCRIPTORS: computer application; utilization; information processing; treatment; character recognition; figure pattern recognition; pattern recognition; recognition; letter; interface; system; graphic input unit; input unit; input output unit; computer peripheral equipment; equipment
CLASSIFICATION CODE(S): JE07000S

33/5/50 (Item 6 from file: 144)
DIALOG(R)File 144:Pascal

11664444 PASCAL No.: 94-0522317
Understanding mathematical expressions using procedure-oriented transformation
HSI-JIAN LEE; MIN-CHOU LEE
National Chiao Tung univ., dep. computer sci. information eng., Hsinchu 30050, Taiwan
Journal: Pattern recognition, 1994, 27 (3) 447-457
ISSN: 0031-3203 CODEN: PTNRA8 Availability: INIST-15220; 354000045447230110
No. of Refs.: 9 ref.
Document Type: P (Serial) ; A (Analytic)
Country of Publication: United Kingdom
Language: English
A system for understanding mathematical expressions is presented. The mathematical expressions scanned from a printed document are recognized and transformed into one-dimensional (1D) strings according to the format of a publication system. After separating all symbols in an **input mathematical expression**, 13 features are utilized to represent each symbol. In order to reduce the computational time, a coarse classification algorithm is applied to reduce the number of candidates. Then for each input symbol, the character with the highest similarity is selected as the candidate symbol. Since some of the symbols in an arithmetical expression may touch each other, a dynamic programming algorithm which uses structural features is adopted to identify correct characters from connected symbols

English Descriptors: Pattern **recognition** ; Dynamic programming; Classification; **Mathematical expression** ; Structural feature

French Descriptors: Reconnaissance forme; Programmation dynamique; Classification; Expression mathematique; Caracteristique structurelle

Classification Codes: 001D02C03

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Un critere pour reconaitre les fonctions algebriquement constructibles.
A criterion for **recognizing algebraically** constructible **functions**
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Let V be a real algebraic set. An algebraically constructible function on V is by definition an integer-valued function which can be expressed as the sum of signs of polynomial functions. The representation theorem of E. Becker and L. Brocker [J. Algebra 52 (1978), no. 2, 328--346; MR 58\#21935] allows one to characterise the algebraically constructible functions among the constructible functions (that is, functions which are integer-valued and constant on each element of a finite semi-algebraic partition of V). The author deduces from this theorem a geometric criterion for algebraic constructibility of a constructible function. A bound on the number of polynomials needed to describe a given

algebraically constructible function is also obtained.